N. A. C. A. BULLETIN

Vol. XXIII, No. 19 June 1, 1942

IN TWO SECTIONS

Section I

IN THIS ISSUE

Production Control in a Foundry,
By George J. Armstrong..... 1289

This Bulletin is published semi-monthly by the National Association of Cost Accountants, 385 Madison Avenue, New York. Subscription price, $10.00 per year. Entered at the Post Office, New York, N. Y., as second-class matter August 28, 1925, under the Act of March 3, 1879.

EDITORIAL DEPARTMENT NOTE

It is difficult to overstress the importance of production control at the present time. The need for stepped-up war production coupled with increased difficulty in securing basic raw materials has made the proper planning and control of production a necessity for the modern plant. The methods outlined in the article in this issue may not be applicable in their entirety to other plants, but there are likely to be few readers who will not obtain some help in their production control problems through a reading of this article.

The author is George J. Armstrong, who for the past five years has served as Staff Supervisor of Costs and Standards for the General Fire Extinguisher Co. of Providence. Mr. Armstrong is a graduate of New York University and has also studied at Columbia. He has had a varied experience in the accounting field in banking, public utilities, and the manufacture of heavy machinery, food packaging machines, pharmaceuticals, textiles, gloves and candy. Since joining N.A.C.A. in 1928, Mr. Armstrong has been a member of the New York, Newark, Brooklyn and Providence Chapters. He is currently serving as Director of Publications for the Providence Chapter.

Articles published in the *Bulletin* present many different viewpoints. In publishing them the Association is not sponsoring the views expressed, but is endeavoring to provide for its members material which will be helpful and stimulating. Constructive comments are welcomed and will be published in the Forum Section of the *Bulletin*.

COPYRIGHTED BY THE
NATIONAL ASSOCIATION OF
COST ACCOUNTANTS
JUNE 1, 1942

PRODUCTION CONTROL IN A FOUNDRY

By George J. Armstrong,
Staff Supervisor, Costs and Standards,
General Fire Extinguisher Co., Providence, R. I.

THE CHIEF purpose of this paper will be to present in something other than fragmentary form a description of how one company succeeded in co-ordinating the efforts required to obtain information for payroll, cost and production control purposes. The procedures which will be described have been in effect for a sufficient period of time to assure confidence that they do not represent some new movement, policy or school of thought that acquires its momentum from the sheer novelty and freshness of the enterprise.

The Company

Since we cannot reveal the identity of the concern where this installation is in actual everyday operation, we will call it "The Pascal Company" to do honor to the success of its managers in the practical application of the essence of the quotation "To foresee is to rule," attributed to that brilliant French savant of similar name.

The Pascal Co., located in a small New England city, is the principal industry in the community, and manufactures for stock a standard product that enjoys nation-wide distribution. This product consists mainly of a grey iron casting produced in a company-owned foundry operated as an integral part of the manufacturing plant as a whole. These castings are cleaned, then routed through other cost centers and departments where the machining operations such as milling, facing, drilling, chamfering, tapping and polishing are performed, to produce the finished product that is eventually routed to the storeroom to await orders for shipment to customers.

Nature of Product

The Pascal Co. does not manufacture screws, but their manufacturing problems do nevertheless possess many of the characteristics of other companies so engaged. The standard product

line is divided into quite a number of distinct classifications, somewhat comparable with the classifications—wood screws, steel screws, flat head screws, etc. Each classification or article in the line is produced in several sizes. Again, like screws, you cannot very well convince a customer that he can substitute a 2" size article X for the item on his order which calls for a 4" article Y. The finished articles delivered to stock may range in weight anywhere from a few ounces to several hundred pounds each. The greater demand for the company's product centers on certain sizes of a fairly compact group of articles. To supply the demand for these, the production departments must keep several patterns and machines in operation practically all the time. However, it is not unusual for orders for a hundred or more different articles or sizes of articles to be worked on during one day in a single cost center or department.

Forms Used

In Exhibit 1 are shown four of the forms used. Form 1 is the only printed form used in the core room or department where the sand cores are made. Form 2 is the principal form used in the molding cost centers. Forms 1 and 2 are set up in duplicate. The duplicate copy is a regular keysort card. The top or original copy is printed on lighter weight stock and is spotted on the back at selected places with carbon. The lightweight copy is a receipt or record to be given the workers who are paid on a piece-work basis.

The foremen, superintendents, or other executives in charge will tell you that the worker's copy of the piece-work labor ticket goes a long way toward maintaining employee confidence and goodwill. Especially is this true at the present time when general labor conditions throughout the country are such that it is to the best interests of every company to create protective measures through the establishment of accurate and infallible records of the performance and earnings of each employee.

Form 3 in Exhibit 1 is the production order issued from a central production control office to the foundry superintendent, and covers both the required production of castings and the production of any cores that may be required for the molds in which the castings are to be formed.

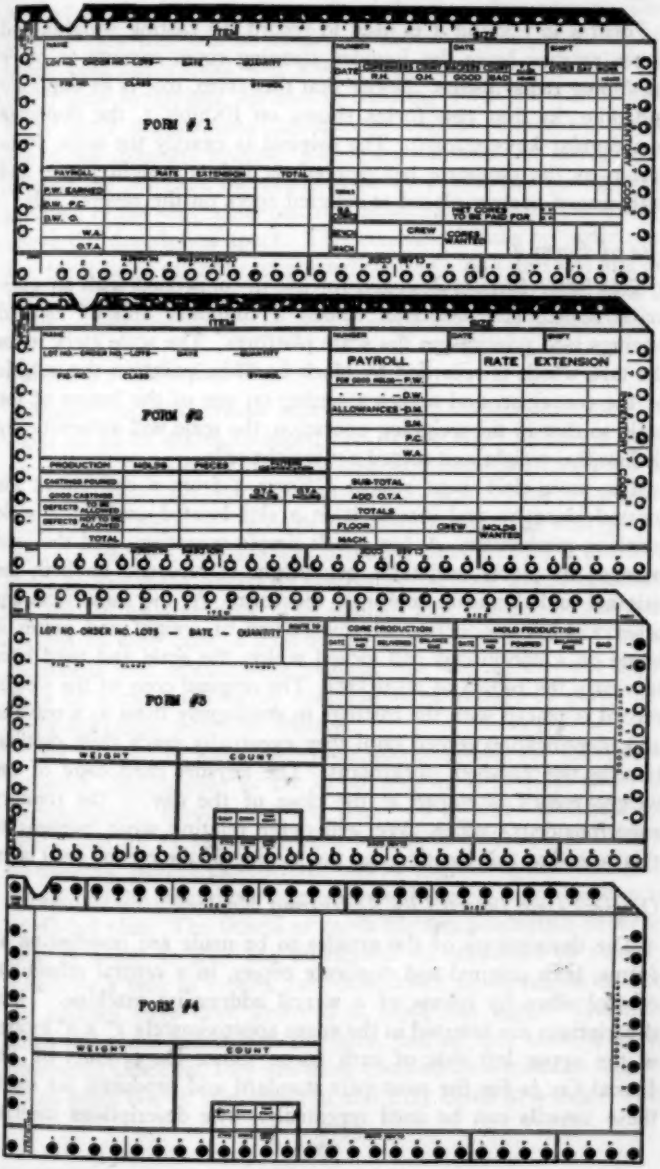
FORM # 1
FORM #2
PAYROLL
RATE
EXTENSION
FORM #3
WEIGHT
COUNT
FORM #4
WEIGHT
COUNT

EXHIBIT 1.

Form 4 in Exhibit 1 is used to record the casting weights and pieces as they leave the foundry cleaning room enroute to other machining departments. Notice that this form, too, is in duplicate and, like the first two forms shown on Exhibit 1, the duplicate is a regular keysort card. The original is exactly the same form design as the duplicate but printed on lighter weight paper and with waxed carbon placed at selected spots on the reverse side.

Use of Form 4

This latter form is designed for use in connection with an automatic scale. The workman wheels a container full of cleaned castings into position on the scale platform. The scale clerk notes the tare which is recorded by black or white paint on the outside of the container, and makes a setting on one of the beams of the scale so that in the weighing operation, the scale will automatically deduct this weight and record net weight only.

The scale clerk next selects a Form 4 from a convenient file located close by and inserts it in a slot located under the scale printing mechanism. A few quick simple operations and the total number of pieces and total net weight is recorded on both the original and duplicate copies of the form. At the same time another exact reproduction of this record of weight and pieces is made on a continuous roll locked within the scale and used later to verify the return of all tickets. The original copy of the weight record is placed with the castings to accompany them as a traveler and identification record until they eventually reach their destination in the finished stockrooms. The keysort card copy of the weight record is routed at the close of the day to the foundry superintendent's office. We will defer relating what happens to this record at this location and the routing of the record until later.

Original Data Inserted by Addressing Machine

The descriptions of the articles to be made are inserted on all forms, both original and duplicate copies, in a central scheduling control office by means of a stencil addressing machine. These descriptions are inserted in the space approximately 1" x 3" located at the upper left side of each form. Since the product of The Pascal Co. is for the most part standard and produced for stock, these stencils can be used repeatedly. The descriptions inserted

are not confined to just the needs of the shop departments. They include data that will be needed or useful to the payroll department, cost department and stock ledger department. They save much time in looking up and re-checking when the forms reach these latter departments through the regular channels provided for in the company routine. The order number, date and quantity wanted are inserted, by means of an automatic numbering device attached to the addressing machine, in the narrow space immediately above the description space. This company breaks an order number for a large quantity of any article down into uniform lots and then ties in these lot numbers and total number of lots with the order number on all lots passing through the shop departments.

Punching and Sorting Cards

Notice the solid round holes that are punched adjacent to all edges on all of the cards illustrated. These holes provide a means for sorting these cards into any desired grouping through the use of the keysort method. The holes are identified with a particular classification or code, through the slotting away of that part of the card between the hole and the edge, thus creating a notch. A notch or any combination of notches is the code which establishes the desired classification. The number and position of the holes allotted to each code is exactly the same on each card. The arrangement was intentionally planned that way so that the advantages of gang grooving or notching large groups of cards by a single operation might be utilized.

The Pascal Co. plans the production schedules for their manufacturing departments as far in advance as is possible under the circumstances; usually not less than two to three months. This means that all of the production orders, molders' payroll tickets, coremakers' payroll tickets, etc., can be duplicated in advance and released to the shop departments as needed or in accord with some scheduled plan. The tickets or cards for any production order are kept in order as they are duplicated. If separated or mixed it would be a task to re-sort them into order again, unless the sorting notches have been grooved in along the edges. Therefore, while the cards are still in the piles, just as they came from the addressing machine, they are gang-grooved by a machine that will notch from one to two hundred and fifty cards at a time. There

can be no mistake because every card belonging to any specific order is coded alike. Although the gang-grooving of the cards is done in the production office at the time of card creation, much of the benefit accrues to the payroll and cost departments. The keysort codes for coremaker or molder number cannot be gang-grooved to the cards in advance. A department clerk punches this information with a hand punch when the workers return the cards.

Other Forms

As previously stated, Forms 1 and 2 of Exhibit 1 are the only printed forms required in the core room for production control, payroll reporting and cost control insofar as regular production operations are concerned.

Naturally, there are other forms such as material requisitions, indirect labor tickets, clock cards, etc.—none of which particularly concern this description. However, most of these other forms are also designed on keysort cards. The keysort feature makes it possible to rapidly sort production time tickets and clock cards in order for clock card verification and to sort production time tickets, requisitions, etc., in order by jobs, product or other desired groups so that any desired statistics can be quickly transferred to a summary form with the aid of any adding machine that may be available.

Coremakers' Production and Payroll Tickets

Accompany us on an imaginary visit to the coremaking department of this company and you will observe for a while some of the various clerical operations performed. An office boy has just brought to the foreman's office a tray filled with the cards illustrated by Form 1 on Exhibit 1, which we know as coremakers' production and payroll tickets. We are told that—

a. These cards constitute authorization or advice to the core room foreman that definite quantities of cores for specific items are to be required.

b. The cards are arranged in the tray in production number order—the cards for each order are clipped together, and there are enough cards for each order so that a new and separate card can be used each time the job is put into production.

c. The date on the sticker on the front of the tray informs the foreman that the tray contains production orders, all of which should be produced not later than the week ending date indicated.

d. An envelope in the tray contains a reproduction of a Gantt type chart, informing the core room foreman as to the manner in which the central production office laid out or scheduled the required production to the equipment and men available.

e. The chart just referred to, is intended to convey information to the foreman as to the order in which it is desired that the work assigned should be completed.

The Gantt Type Chart

The Gantt type chart adopted for use by this company is illustrated in Exhibit 2. The information on the exhibit provides a key showing how the data on the chart is set up. The primary purpose of this chart is to convey information to the foreman on how the central production office planned the work load for his

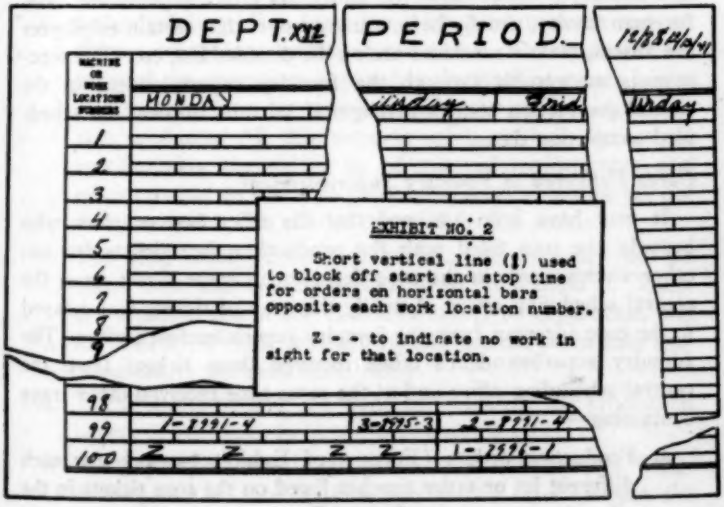

EXHIBIT 2.

department as a part of their activity of co-ordinating the work facilities of all manufacturing departments. It is not necessarily intended that the foreman or foreman's clerk should devote any time to inserting the heavy cumulative lines representing work done to date or other symbols to represent reasons for delays, etc., usually associated with the maintenance of such charts. A short vertical line is all that is used to plot required production against the time scale in place of the more familiar light horizontal line, used in texts illustrating or describing the use of Gantt charts.

This foreman's chart is an exact reproduction of the revised schedule set up on the planning mechanism in the central production scheduling office. It is at this latter location that a follow-up is maintained on the progress made in the core department (or any other department) in relation to schedule. How this follow-up is accomplished will be related later.

Latitude Allowed Foreman

It should be made clear at this point that the foreman is allowed considerable latitude when delegating work to specific machines. He is the one person who should be best informed on the merits and abilities of each employee under his direct supervision. The foreman knows, usually before anyone else, that certain employees are absent, certain machines are on the disabled list, etc. The foreman is answerable through the foundry superintendent to the central production control manager if he fails to meet the scheduled completion dates.

Cards Delivered to Foundry Superintendent

It may have been assumed that the office boy or clerk who brought the tray filled with the production time tickets for another week's work in the core department, came direct from the central scheduling office. Actually this tray of tickets was relayed to the core foreman from the foundry superintendent's office. The foundry superintendent's office received these tickets from the central scheduling office and at the same time received other trays containing—

a. Production orders (Form 3 of Exhibit 1)—one for each different lot or order number listed on the core tickets in the other tray.

b. Molders' production time tickets (Form 2 of Exhibit 1) to apply to production orders either in the tray just received or previously received. These molders' tickets, like the core tickets, are arranged in the tray in production number order, the cards for each order are clipped together, and there are enough cards for each order so that a new and separate card can be used each time the job is put into production.

c. A Gantt style chart showing how the central scheduling office laid out the production to be required from the molding department.

The General Plan

Now we can sense some of the concepts that give action to the plan through which this company controls production:

a. The line of authority so far as schedules of production are concerned, runs from the manager of the production scheduling office, through the foundry superintendent to the foreman, and through the foreman to the workers under his guidance and supervision.

b. The schedule of required production is planned by the central scheduling office from the finish point back through all the preceding departments or cost centers that must perform some of the operations required in the stage of events necessary to transform the raw materials into good finished, salable products. All this requires much work in the use of specifications, the setting up of material requirements, and other records necessary to production control, but we are not concerned with this side of the work in this article.

c. The plan finally evolved is permanently recorded on the Gantt style charts such as illustrated on Exhibit 2. There are separate charts for each cost center or department and the charts for each unit are further broken down into separate charts for each work-week.

d. These charts become the basis for releasing the production orders or schedules to each manufacturing unit.

e. Automatic provision is made for the maintenance of whatever spread of time it is desired should exist between the completion of operations in one department and the com-

mencement of the next operations on the same order in the succeeding departments.

Recording Changes in Production Plans

As previously stated, the Pascal Company plans their production schedules as far in advance as is possible under existing circumstances. This is the plan that is permanently recorded on the master Gantt style charts. These charts demonstrate whether or not all of the production that we know will be eventually required, can be produced on the facilities available. The decisions of the company's executives relative to action for the future are materially fortified through this advance information.

Changes are bound to occur that will affect the plans recorded on these charts. Some items originally scheduled for production at later dates will have to be brought forward to a more current position on acount of demands being heavier than anticipated. Orders for specials not regularly stocked will be received, and must be fitted into the schedule. Other items for which a normal demand was expected, will either move slowly or not at all. The clerks in the central production scheduling office make notes concerning these changes direct to the charts held in the master file.

The Planning Board

It was stated that the Gantt chart contained in the envelope that accompanied the tray full of coremakers' tickets to the core department was a reproduction. This is literally correct because the chart that was forwarded to the core room was reproduced from information appearing on an ingenious mechanical device set up in the central scheduling office. In brief, this device is a series of visible panels, designed to operate as a Gantt style chart visible planning board. A time scale is marked off across the top of each panel. The time interval—horizontal space units on this scale—is exactly the same width as the time space units used on the Gantt charts. The total overall length of the scale is exactly double the width of the Gantt charts. This means that the planning board will display a layout for an amount of work on one panel equal to what can be planned or laid out on two Gantt charts. Deep grooves or tracks replace the lines of the Gantt chart, and card holders placed opposite each line provide spaces for the insertion of the machine or work location numbers.

Operating the Planning Board

Sometime during the week a clerk in the central scheduling office prepares from the master file the Gantt style charts for the next week's production for release to the shop departments and resets the data on one of these panel boards. All corrections such as additions of new or special orders, or other notations on the master charts are taken into consideration at this time. The date or hour when work is scheduled to start on a new order is indicated on this board by inserting a white catalin block in the groove that runs on a horizontal plane with the machine or work location number to which the job has been assigned and directly under the position on the scales at the top of the panel that indicates the date and hour desired. The order number is written on the surface of the block in pencil, ink or crayon. Another colored wooden block is placed in the same groove, but in a position a little further on to indicate the date and hour on which this job is scheduled to be completed.

The first catalin block may be said to correspond with the right angle opening to the right usually used on Gantt charts to indicate the starting time for orders. The second block (colored wood) may be said to correspond with the right angle opening to the left, usually used on Gantt charts to indicate when orders are scheduled to be completed. It is a usual practice when setting up regular Gantt charts to connect the two right angles representing "start" and "finish" with a light horizontal line. Above this light line, but between the angles, may be written whatever numbers and quantities may be necessary to identify the order. The very same purpose is accomplished on the panel board by writing the identification data on the block. These blocks can be used repeatedly as any writing on them can be quickly removed by rubbing or washing as on a blackboard or slate. Since blocks are used to indicate only the start and finish points, the number of blocks that a clerk must handle are reduced to a minimum. Therefore the total clerical time required each week to set up the complete panels for all the departments involved is very small.

As soon as the setup on the panel for a department is complete, a transcript of the layout is made to a new Gantt style chart. This is the way the chart which we encountered in the core room was prepared.

Data Transmitted to Productive Departments

The clerk, in the central scheduling office, draws the production time tickets for the jobs listed on the chart from the files, and places the charts and cards in a tray for dispatch to the foundry superintendent's office. This same clerk also draws the production orders from the files (Form 2—Exhibit 1) for any new lots or orders that are being started into the manufacturing process for the first time—for the most part this will represent all orders placed on the core department plus some few orders started initially in the molding departments because no cores are to be required—and places them in a separate tray for dispatch to the superintendent's office.

The number of keysort production time tickets which the central production office will release with an order is governed by the number of times it is expected a job must be started and stopped before it is finally completed. The coremakers and molders may each work on several different jobs during one day, and again on these same jobs the next day. The explanations for this condition are somewhat technical and will not be considered here.

Recording Status of Orders on Planning Board

We have up to this time referred to the scale at the top and bottom of each board or panel as representing hours. This scale can also be interpreted to mean production or work to be performed within a given space of time.

Let us assume that an order which calls for 2,000 pieces and requires ten hours to produce is assigned to a specific machine. A block is placed on the board to indicate when the work on the order is scheduled to start and if each space interval on the scale is read as one hour, then the final block will be inserted over the tenth division beyond the starting point. These divisions can be read just as easily as units of production so that in this illustration each space interval would represent 200 pieces.

Sometime each day, the production time tickets representing work done on the previous day or earlier during the same day are routed through the central scheduling office. A clerk keysorts them into order according to product identification symbols, and then proceeds to plot the results on the control board. The card

for each order shows the total quantity that the shop department was instructed to produce on that order. This information was inserted by the numbering device we previously stated was incorporated into the addressing machine.

Each production time ticket also reports at this point the total pieces a specific worker produced on that order in some certain department on the date indicated on the card. Each production time ticket also indicates the total balance that was due on the order, exclusive of the production for the day. This balance of production still due or the total time required to complete it, is represented on the panel board by the total overall distance between the two blocks assigned to that order. It is an easy matter, with all these facts available, for any clerk to learn how to interpolate, and then deduct the production for the day by moving the white block the approximate correct distance toward the right. The act of doing this will change the visible relationship of these blocks to the date line indicator and so presents an up-to-the-minute picture of "what's doing in the shop departments."

The Date Line

There is a gadget on the panel boards that provides the means for visible follow-up of performance versus schedule. We previously stated that we would have more to say later as to how it was accomplished.

Many of you, without doubt, have seen those parallel bars that are available for use with drawing boards, the kind that have small pulleys on each end through which cords are run, then across the board, and finally the cord ends are fastened to cleats on the side. The draftsman can move the straight edge up and down on the board at will and always be certain that any lines drawn will be exactly parallel with all others. A similar device is attached to each panel. Instead of a straight edge, a narrow metal bar is used and arranged to move back and forth over the surface of the panel instead of up and down as did the drafting board instrument. The rod or bar is high enough from the surface of the panel so that the blocks placed in the grooves will not impede its free movement.

The movable vertical bar represents a date line. It is moved to a position on the panel to correspond with the current date. Some

white blocks will be to the left of this bar. These blocks represent orders that are falling behind the scheduled times. The first white blocks in other grooves may be to the right of this bar because the orders assigned to those machines are running that much ahead of the scheduled times.

Clerical Routing in Foundry Office

We return to the foundry superintendent's office and devote a few moments to learning how the production time tickets, production orders, charts, etc., contained in the trays received from the central scheduling office are disposed of, and then continue our imaginary visit on through the coremaking department.

We are informed that a clerk in the foundry superintendent's office—

a. Compares the order numbers shown on the coremakers' tickets and molders' tickets with the numbers inserted on the respective work layout charts for each department to make certain that all required cards or tickets have been received.

b. Compares the total cores to be produced and indicated as the opening balance in the core section of the production order with the total cores to be produced and inserted as the opening balance due on the first coremaker's ticket. The quantities entered in both spaces should agree. These spaces are indicated by entries on Forms 1 and 3 on Exhibit 1.

c. Keysorts the cards that are the new production orders into the file of cards that represents the production orders already in process.

d. Dispatches the trays containing the coremakers' and molders' tickets and layout charts to the foremen of the respective departments.

The column on the left side of the Gantt chart illustrated in Exhibit 2 is headed "Machine or Work Location Numbers." These numbers refer to specific machines or work bench locations in the core room or any other department to which a specific chart applies. At each such location, usually fastened to the machine or bench, or other convenient location, is a flat board about one foot square, with the location number displayed in large red numerals

toward the top center, and a file pocket large enough to hold a few production time tickets, toward the bottom center. A spring clip is fastened to the face of the file pocket and so positioned that any cards in the clip are wholly visible, yet do not prevent the foreman or others from noticing, by a casual glance, that there may be cards in the pocket as well.

Control Boards in Foreman's Office

There are two visible control boards, differing somewhat in design, set up in the core department foreman's office. The first control board is a series of pockets, arranged in three rows with, we will say, ten pockets in a row. These pockets contain the coremakers' tickets for the jobs which the foreman has actually planned ahead for each work location in his department. Usually this plan is in accord with the layout prepared by the central scheduling office. The work location number is displayed in large red numerals beside each pocket. If you were to view this control device from the side, it would give an appearance somewhat like an 'L.' The bottom part of this 'L' is a tray that projects from the control but is a part of it. This tray is divided in the middle and each half is again divided so that we have four sections each the same width as a coremaker's ticket and deep enough to hold all the cards for a quantity of orders. The sections of this tray are labelled to indicate—

Bench jobs—A	Machine jobs—A
Bench jobs—B	Machine jobs—B

The second control or work dispatch board is approximately the same size as the first one just described. The card pockets are replaced by spring clips which are spaced and arranged in rows to correspond with the pockets on the visible plan-work board. Again we note the work location numbers are displayed in large red numerals beside each spring clip. Production time tickets placed under any of the clips on this board are wholly visible from a considerable distance.

Production Control in the Department

The procedure for utilizing the equipment described can be summarized as follows:

a. The foreman keeps jobs planned ahead for the workers at the various work locations by moving cards from the original tray to a pocket on the first board.

b. The foreman follows the plan laid out in the central scheduling office, when assigning work to these locations, unless there is some good reason for him to do otherwise.

c. There may be one to several cards for each order in the tray as received via the superintendent's office, clipped together. All of the cards or tickets belonging to an order are placed in the pockets on the first board.

d. If the foreman plans the release of several jobs ahead for a single work location, the cards are placed in the pocket for that location in the order in which the orders are to be worked.

e. The top card or ticket is the only ticket that contains the information as to the total number of cores to be produced. When the layout chart or a good reason, calls for a limit on the quantity of cores a worker should produce at one time before starting work on a new order, the foreman makes a notation to this effect on the top ticket.

f. The machine setup man keeps himself posted as to the jobs coming up, by constant review of the cards in the pockets for each work location. He is responsible for seeing that the core box or pattern together with any special driers that may be required are in good order and at each work location prior to the time they will be needed for the job.

g. When the coremakers check in for work, the foreman (or clerk) gives them top ticket from the cards for the first job in order, found in the pocket on the plan-work board, the number of which corresponds with the location of the machine or bench on which each coremaker is to work. The worker's clock number is inserted in the space provided on the card at that time.

h. The balance of the tickets for each order just released to the workers, are placed under the clip on the next board, the number of which corresponds with the location of the machine or bench on which the job is being done. This provides

a visible check in the foreman's office as to "what is doing" at any moment at any work location in the department.

i. The coremaker places the production time ticket which he received when he checked in for work under the spring clip, one of which we previously stated was located at each work location. This provides a visible check whereby inspectors or others out on the floor can know what job is being processed at any work location at any moment of the day.

j. The foreman knows that some men will complete the quantity required on the job they are on in a relatively short while. As the foreman wishes to keep lost time due to waiting for work down to a minimum, he (or his clerk) removes the top ticket from the next order in the pocket of the plan-work file assigned to that location, goes to the work location, and places it under the clip and under the card for the order that worker is working on at that moment. The setup man should have the necessary patterns, etc., ready for the worker to continue without interruption when his present order assignment is finished. The balance of the tickets for this order are allowed to remain in the pocket of the plan-work file until work is actually commenced. This is signified by the return of the tickets for the previous order.

k. When a coremaker completes a job, he (or an inspector) removes the ticket from under the clip on his work location designation board, and places it in the pocket directly back of the clip. This automatically brings the order ticket for the next job he is to work on into full visibility.

l. An inspector or sub-foreman will pick up this ticket a short while later, verify that all cores made have been put on racks ready to go to the baking ovens, that the rack numbers are inserted on the ticket, and the coremaker's (or inspector's) count has been properly inserted. He will then separate the tickets, give the light paper copy to the coremaker and return the keysort copy to the foreman's office.

m. The clerk in the foreman's office will remove the balance of the tickets for that job from under the clip of the second board, deduct the production just completed from the orig-

inal quantity wanted and insert the new balance due, in an identical space on the next, or new top card for the order.

n. The production time ticket just turned in, is placed aside in a box or other container to await further verification of the count shown, as well as a determination and recording of the good and bad pieces obtained. At frequent intervals throughout the day, the clerk will stamp the date and notch out the proper holes in the sorting field of each card delegated, for the keysort code for coremakers' clock number.

o. The clerk will not return the balance of the work tickets for that order to the tray from whence they originally came. Therefore any cards for orders still remaining in this tray represent jobs that have not yet been started into production.

p. The clerk returns the balance of the work tickets for the orders returned from production in the manner described above to one of the file trays attached to the bottom of the plan-work board. Two of these tray sections are designated for bench jobs; the other two sections for machine jobs. The layout chart usually provides that any jobs once started will be continued, either in one single run or in daily runs until completed. The trays provide an easy method for keeping such jobs in motion and at the same time keeping the look-up and clerical time in handling, down to a minimum.

This completes the story on—

1. How the work is planned or laid out for each department.
2. How a department is advised concerning this plan.
3. How a department foreman puts the plan into action.

Verification of Production of Good and Bad Cores

The story of the clerical activities in the core department cannot be completed and tied in with the methods previously described until we briefly discuss the racking and baking of the cores. The objective at this time is to provide a means for identifying the cores on the racks with the production time tickets turned in by each molder so that we can obtain—

a. A verification of the coremakers' count.

b. A record of the good and bad cores to be posted to each ticket.

There are men in the department who are assigned to the task of collecting the green sand cores from the coremakers and arranging them on steel racks which, when completely filled will be lifted and wheeled into ovens and baked. Each one of the racks is numbered. A small plate made of a composition material is attached to one end of each rack. Chalk marks made on these plates are easily read and afterward are as easily erased.

Identification

When a rack packer starts to remove the completed green cores from a coremaker's work location table for a specific order, he inserts the rack number, on which he is placing these cores, on the coremaker's ticket. If he places the cores on two or more racks, the additional rack numbers are posted to the card. It is very infrequent that any order is in process at more than one work location at the same time, but a work location may require anywhere from one to several operators. On the other hand, the volume of green cores produced on a specific order at some of these work locations will require baking space on two or more racks. The removal of the cores from the coremaker's worktable and the racking and baking may go on while the coremaker is working on an order, so that when the coremaker completes his task, only a few moments elapse before the balance of his production on that order is on the way to the baking ovens.

If the clerk is to properly perform the clerical duties to be described soon, and the foreman is to have a positive check on the quantity and quality of production of the workers under his supervision, it is necessary that the racks on which the cores were packed be identified on through the baking ovens and up to the time they are unpacked. The foreman's clerk stamps the date on the production time tickets received from the coremakers at the completion of jobs, or on all tickets turned in at the close of the day whether the job was completed or not. The rack packers insert the rack numbers on which the cores were packed on the coremakers' tickets. All that is needed now to make the identification complete to the end of the cycle is to establish some way of

knowing the date the cores on any rack were made and to establish a definite rule that core production for one single day only be loaded or packed on any rack at one time. Therefore, as soon as any rack packer starts loading a rack with cores, the date is written with white chalk on the small plate previously mentioned as being attached to the end of each rack. It is only necessary to write the number of the date such as 1, 8, 16, 31, etc. Since the department happens to be working two shifts at the time of our visit to The Pascal Co., we are told that they distinguish the racks for cores produced during each shift by chalking a "D" for day or "N" for night on the plate before the date numeral.

Determining Good Production

All coremakers are paid on a piece-work basis for the good green cores they produce. The count entered on the production time ticket by the inspector or coremaker is later verified and any errors in count are corrected. In the meantime an inspector checks the green cores produced at the start of each new order. If these cores are not satisfactory, they are discarded and the sand mixture returned to the hopper. The inspector then resets the machine to get the required results. The machine may be set correctly, but the worker may become careless and so produce defective work. If the inspector discovers such work in the green core stage, he will order the cores to be broken, sand salvaged, and count deducted from the coremaker's count. Most of the defective cores over which the coremakers can exercise any control are discovered at the source and handled in the manner cited above. We will find that the greatest losses on spoiled cores occur in the handling, baking and other operations beyond those performed by the coremakers.

Procedure for Verification

The core department foreman's clerk must be certain that each production time ticket records the quantity that the coremaker is entitled to be paid for. Therefore counts must be verified. Since the production order requires the production and delivery of good cores to the molding departments, he must also obtain a reliable record of the good and bad cores finally resulting from each day's production. This second responsibility relates to the clerical oper-

ations that are performed after the racks filled with the baked cores are removed from the ovens. We will not describe all the clerical operations performed. Instead we will attempt to select from the instruction manual detailing the duties to be performed by the clerk, those we consider of major importance and helpful to an understanding of the procedures involved.

1. All of the baked cores on all racks delivered from an oven—both good and bad—will be counted by the core department clerk and the amount recorded on horizontally ruled padded sheets 5" x 7", held in place on a clip-board.
2. Before any core counts are entered on a sheet, the core room clerk will copy to the first line the identification data for the rack; namely, the rack number and the date. For example, he may write "D18—No. 44." He will then write a brief description of the cores he is about to count, count the total cores of that description, and enter. On the next line he will write a brief description of the next cores to be counted, count and enter, etc. When he has completed counting all the cores on a rack, he places a red chalk-mark check across the date, which informs the core packers that that rack is ready for final inspection and boxing.
3. When the clerk has finished counting the cores he returns to the foreman's office and posts the totals to the production time tickets for that day and shift. These totals are inserted in the column headed "O. H." As the clerk makes these postings he checks off the rack number which was inserted in the larger space to the right of the spaces provided for payroll extension. When he has all the rack numbers checked off, the total of the postings in the "O. H." column should agree with the total entered in the "R. H." column. If not, the racks and the cores are still on the floor, and any desired re-counts can be made. All discrepancies are brought to the attention of the foreman.
4. The clerk now removes this sheet from his pad, and places it in another clip-board which already contains the sheets for the racks previously counted and entered, but which have not yet been checked out by the final inspectors. The racks are emptied or unpacked in the order in which they

come from the ovens. The two clip-boards are used to avoid confusion that might be caused should two people want to use the clip-board at the same time, a condition that might frequently arise if only one board were available.

5. The boxers (who are also inspectors) unload the racks and put aside all bad cores, until all the cores on that rack have been boxed. The head inspector for the crew then takes the second clip-board to which previous reference has been made, counts the bad cores and enters these counts on the particular sheet applying to that rack, after which he returns the clip-board to the place provided. The chalk marks on the plate are removed or erased at that time. The clerk posts the bad cores to the proper tickets at frequent intervals throughout the day, deducts the total bad from the total made and inserts the balance as good cores.

Replacing Bad Cores

Notice now that the good cores reported made by the coremakers becomes the basis for determining when an order is completed in the core room. The production order requires the delivery of a definite quantity of good cores to the molding departments. Any unusually large quantities of bad cores produced are added back to the balance on the production ticket which at that moment indicates the balance due. No erasures are allowed. Instead the clerk creates a new total by adding to the initial balance on the card the quantity of bad cores to be added back.

Small quantities of bad cores produced are not added back into production in this manner. Instead they are allowed to accumulate. When the core department clerk notes that the order is about to be finished, he contacts the superintendent's office where the deductions from balance due on the production order are made on the basis of good cores, obtains their balance still due and uses this information to adjust the balance on the card or order in process in the core room.

Co-ordination Obtained Through This Plan

The core department clerk routes the completed production time tickets to another clerk in the foundry superintendent's office. There, the good cores produced are recorded on the production

orders (Form 3—Exhibit 1). They are then routed to the payroll and cost department via the central scheduling office. Therefore, through one card originally created in a central scheduling office from a previously checked fibre addressing stencil, The Pascal Co. obtains the fullest measure of co-ordination and economy for obtaining information for payroll, cost and production control.

Methods similar to those described as used in connection with the control of the core department are used in all other departments. For instance, you will recall that a traveler was created when the finished castings were finally weighed and counted, and that another report card record of the weights and counts, created at the same time, was routed to the foundry superintendent's office. The information on this card plus information on another inspection card not commented on, becomes the basis for determining, checking and recording the good production from the molding departments. This keysort weight card is then routed on to the central scheduling office where it is filed as a new addition to the card record of physical castings in process. The cards are cleared from this file on the basis of traveler copies returned which means that these castings have been converted into finished stock. Again, The Pascal Co. scores by obtaining a perpetual inventory of castings in process from a card originally created in the central scheduling office and which card has in the meantime served several other purposes.

We could continue to far greater length, the story of the various ways that the management of this company has further simplified and co-ordinated the activities of these departments. We have of necessity omitted much detail.

OFFICIAL
N.A.C.A. LAPEL BUTTON

Every member of the Association ought to have an Official Button to wear at Chapter meetings, National gatherings and other business conferences.

These buttons are a reproduction of the seal of the Association in blue enamel on a gold plate base. They constitute a distinctive emblem—a worthy evidence of your affiliation with the N. A. C. A.

The price is $1.50. Orders should be sent to National Headquarters accompanied by remittance.

National Association of Cost Accountants
385 Madison Ave., New York City